VALUABLE BY-PRODUCTS OF COTTON.

The question of opening up the markets of Japan and the far East for our cotton has given the Southern growers a slight hope for better times; but, while the prospects of another large crop keep prices down, and affect the planters disastrously, science is steadily laboring to widen the field of consumption and to create new industries that will utilize all of the by-products of the crop. The achievements in this direction have been so noteworthy in the past that one is led to place implicit confidence in the promises for the future. By the single discovery of the value of the cotton seed for manufacturing oil and cotton-seed meal, some ten to fifteen million dollars were added to the receipts of the annual cotton crop. Now that an enormous industry has been built up and permanently established for converting the cotton seed into oil, the question of utilizing other parts of the cotton plant for commercial purposes has come rapidly to the front.

Originally the lint was considered the only valuable part of the cotton crop, and the seeds, the stalks, the roots, and hulls were either burned on the land or turned under the soil by the plow to increase the fertility of the land. It was supposed that the cotton drew so much fertility from the soil that it would soon rob it of all power for plant production and in time make it worthless. Scientific investigations and analysis of the soil have demonstrated, however, that, of all the staple crops, cotton imposes the slightest drain upon the land. By applying special fertilizers, all of the crop can be removed year after year without materially injuring the soil. Thus cotton has been raised on the same plantations for over half a century, and the land to-day is almost as fertile as when the virgin soil was first broken with the old wooden plow.

This demonstration has led to important results. After the cotton seed, the cotton-seed hulls were selected for scientific investigation. The hulls of a cotton crop constitute about half the weight of the ginned seed. These hulls are hard, dry, and apparently useless, and they are covered with a fuzzy lint that further detracts from their appearance. In fact, until very recently they had no practical value, and they were disposed of in various ways by different planters. The majority returned them to the soil to help fertilize it; but analysis showed that their constituent elements did not enrich the land to any great extent.

But as substitutes for hay the cotton-seed hulls are of incalculable value. Heretofore the hulls have been used by a good many of the cotton-seed mills for fuel, and as fuel they are worth about 80 cents to 90 cents per ton; but as animal food they are worth far more. Experiments were first made a few years ago in the vicinities of the oil manufacturing centers, such as Memphis, New Orleans, Houston, Little Rock, Raleigh, and Atlanta. It was found that when mixed with condensed foods the hulls were readily eaten by the animals, and that they were of great value in helping to digest and assimilate bran, cracked corn, and meal. Moreover, it was proved by a succession of feeding tests that 10 per cent of the protein of the hulls was digestible, 38 per cent of the fiber, 40 per cent of the nitrogen extract, and 77 per cent of the fat. The hulls are light and bulky, but otherwise they make a good substitute for hay in the South, where grass crops have always been notoriously small and inferior. The hulls are baled or pressed into sacks, and in this condition they keep for a long time. When packed away in bulk, like hay, they ferment and heat.

Now that the cotton seeds and hulls have been profitably disposed of, the stems of the plants have attracted attention, and already they have been successfully utilized. As a by-product of the cotton crop, the stems promise to prove as important as the hulls. The plants of the cotton crop have long ranked in the South as a coarse animal food, about equal to the same quantity of rye, wheat, or oat straw. After the crop was harvested the animals were generally turned loose on the land, and they would eat the stubble in places and grind some of it into the soil. These stems would be stripped of their foliage and tender twigs by the cattle, but the hardy, dry stalks would be left untouched.

The question of utilizing these stems as fiber for cotton bagging attracted attention some years ago, but it was only recently that a process was patented for this purpose. The stems are very rough and coarse, and scientists found some difficulty in making machinery that would work up the material satisfactorily. The fiber was found to be good when once stripped and sorted out. Samples of the bagging made from the stems have been tested in the South, and it is pronounced by experts to be first-class in every way. The yield of the fiber is large, and when satisfactory machinery is produced a considerable bagging industry will be built up near the cotton fields. Five tons of good stalk will yield about 1,500 pounds of first-class fiber. At this rate the annual cotton crop will produce all the bagging needed for cotton baling and leave a good percentage for other purposes. Of course the industry is largely in the experimental stages yet, but if it works as well as the cotton-seed oil industry did, it will not be many years before it will assume **gigantic proportions.**

In Egypt, the common cotton of the Nile districts (Gossylii radicis cortex) produces a large root, the bark of which has long been used for medicinal purposes. The action of this bark is similar to that of ergot. This fact has led to investigations here, and it is believed that another by-product of the cotton crop will be soon found in the roots of the plants. The drug would be useful in many ways and might prove of great value. Chemists have approved of it, and it is now largely a question of extracting it profitably.

In connection with employing the cotton-seed hulls as food for animals, it might be said that any surplus of the crop can be utilized in making artificial fertilizers. Cotton-hull ashes are very valuable for furnishing a cheap potash for the tobacco crop, and there is quite a demand for it in all of the tobacco growing districts of this country. The quality of these ashes varies, but, as a rule, they are of considerable value.

This leaves little of the cotton plant either to go to waste or to be returned to the soil. Every part of it is turned to some profitable use, and as the years go by new uses for the products will be discovered. Already the cotton-seed oil—the most valuable by-product of the crop—has found its way into fields never dreamed of when it was first extracted. Improved methods of refining it are gradually forcing the oil into direct competition with more expensive oils. It has been found that the upland cotton seeds yield a purer and better oil than the cotton raised along the seacoast. The climate also has much to do with the quality of the oil, and under the same conditions, cotton-seed oil made in this country is superior to that manufactured of the Egyptian or Indian cotton seed. The oil first extracted by expression is odorless, and of a dark, brownish-green color. This is treated with alkaline solutions, and a clear, yellow, pleasant, and odorless oil is produced. The residue is called soap stock and enters largely into the manufacture of soaps. The refined oil is consumed chiefly as a food product, as it makes a good substitute for salad and cooking oils, and also for packing sardines and other fish. It has its limits, however, and the manufacturers have not been able to make it take the place of oils for mixing paints and wood-fillers. It dries very slowly and imperfectly, and this seems to debar it forever from entering into competition with linseed and similar oils for the drug and paint trade. As a lubricant, the best refined cotton-seed oil is very satisfactory, and it is in considerable demand in the machine trade.

Refining processes are constantly developing new uses for the oil. The yellow oil resulting from the first process of refining, through treatment with alkaline solutions, is further purified by heating and filtration. Then the white oil of commerce is obtained by shaking the yellow oil with 2 to 3 per cent of fuller's earth. In purifying the yellow oil about 25 per cent of it is separated in the form of stearin. This cotton-seed stearin is employed in making candles and the various preparations of butter and lard surrogates.

For some time this cotton-seed oil was mixed with lard intended for cold climates, and then its fluidity was corrected by mixing it with beef fat. Now this is often sold on its own merits in the market in open competition with lard.

Finally, there is a wash powder made from the soap stock that owes its origin to cotton-seed oil. This is obtained from the residue left after the oil is refined. The soap itself, made from the oil, is used extensively by the woolen mills of this and other countries. It has been found to be of special value in washing woolen goods, which it does not injure nor cause to shrink.

Thus it is that the by-products of the cotton crop are multiplying, and in the end they may prove more valuable than the lint. At present not much more than one-third of the cotton seed is used for manufacturing oil and similar products; but, as the demand increases, and facilities improve for handling the seed, the value of the crop will increase, and in time cotton-seed oil will represent an annual value more than equal to the actual worth of the cotton lint.

THE PLAGUE IN VIENNA.

The outbreak of the bubonic plague in Vienna, due to the experiments in Prof. Nothnagle's bacteriological establishment, has spread terror in the Austrian capital. They have several cases in addition to those which resulted in the death of Dr. Mueller and Herr Barisch. Dr. Mueller was considered an authority on the plague and spent some time in Bombay for the purpose of studying the plague on the spot, and he survived all the dangers of this place to succumb to the deadly bacillus at Vienna. Extraordinary precautions have now been taken to prevent an epidemic. The plague patients lie in an isolated building and are attended by Dr. Pooch, a volunteer physician, and by Sisters of Charity. They are cut off by a rope which no one is allowed to pass. The doctor writes the prescriptions and pastes them on the window pane. The doctors outside read them and have the medicines put up and they are placed on the window ledge; after they have retired to a safe distance, the medicines are taken inside. Food is conveyed to the patients and their attendants by the Sisters of Charity in a similar manner and a telephone is used to give information regarding the changes in the patients' condition. Everyone who came in contact with Herr Barisch has been isolated. Some of them attempted to escape, but they were all captured and locked up, but it is feared the precautions were taken too late. Both he and his wife have visited friends, rode in public conveyances, and came in contact with dozens of persons, which has resulted in great excitement in medical circles. It is the opinion of the doctors at the Austrian capital that the plague is likely to spread. A temporary hospital was erected by torchlight. Dr. Mueller heroically took observations of his own condition and the questions of the disease until he died. His coffin was partially filled with sawdust saturated with carbolic acid. All bacteriological observations have been suspended, and the animals used in the experiments have been burned.

PATENTS AND COPYRIGHTS IN CHINA.

Under date of July 18, United States Minister Conger sends from Pekin the following clipping from the North China News of July 12, purporting to be a translation of a recent decree of the Emperor in regard to the enactment of copyright and patent laws.

It would appear from this decree, says Mr. Conger, that China is about to give her men of literary and inventive genius the same recognition and protection accorded them by other nations; and it is indicative of the great changes soon to take place in the country. Unfortunately, since the issuing of this statement by Mr. Conger affairs have taken an unfortunate turn in China, and it is impossible now to tell when the new laws will be enacted. It remains to be seen how far the Dowager Empress and Li Hung Chang will allow the measures of reform and reconstruction to be carried.

"The following important imperial decree, which is really the promise of the enactment of copyright and patent laws, was issued on July 5.

"From ancient times until now, the first duty of government has been to bring order out of chaos and shape the rough materials at hand. With the increasing facilities of international commerce, our country has been filled with an influx of scientific, mechanical, and artistic things which are an education to the masses, whose eyes are daily being opened to their usefulness. China is a great country, and our resources are multitudinous. Men of intellect and brilliant talent, capable of learning and doing anything they please, are not lacking; but their movements have hitherto been hampered by old prejudices which have formed a bar in thinking out and introducing to practical use new inventions. Now that we have entered upon the highroad toward the education and enlightenment of the masses, for the purpose of making our empire strong and wealthy like other nations, our first duty should be the encouragement and employment of men of genius and talent. We therefore hereby command that from henceforth, if there be any subject of ours who should write a useful book on new subjects, or who should invent any new design in machinery, or any useful work of art and science which will be of benefit to the country at large, he shall be honored and rewarded by us in order to serve as an encouragement and exhortation to others of similar genius and talent. Or, if it be found that such geniuses have real ability to become officials, we will appoint them to posts as a reward, or grant them decorations or fine raiment in order to show the masses the persons who have gained honor by their talents and genius; while they shall also be allowed to enjoy the fruits of their labors by being presented with papers empowering them to be the sole manufacturers and sellers within a certain limit of time. Again, to such as have administrative talents and the necessary funds either to build schools, or begin irrigation works for the benefit of agriculture, or build rifle factories or cannon foundries, all of which will be of great benefit to the population of the empire at large, shall be granted rewards on the same scale as men who have gained distinction in the army or navy, in order to give them special encouragement to work for the good of themselves and their country. We hereby further command the Tsungli Yamên to draw up the regulations which shall govern the various matters noted within this edict, and report at once to us."

DEATH OF COLONEL WARING.

Just as we go to press it is our painful duty to record the death, on October 29, by yellow fever, of Colonel George E. Waring, Jr., at his apartments in New York city.

Colonel Waring contracted the dread disease while in the service of the government at Havana, so we must add one more name to the honorable roll of those who have died for their country as a result of the Spanish-American war. Colonel Waring was sent to Havana to give advice in his capacity of expert sanitary engineer, and he contracted the disease while devising means to drive the scourge from its home in Havana. We will give a biographical notice of Colonel Waring in our next issue.

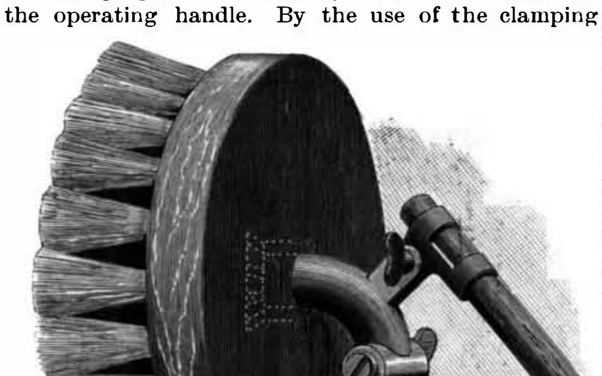
An Explosion of Liquefied Air.

A serious accident with liquefied air occurred on October 21 at the Polytechnic Institute, Brooklyn, N. Y. Prof. Irving W. Fay, in trying an experiment with mixing liquefied air with red phosphorus, caused an explosion which injured him severely and also burned one of the students. The day previous to the accident, four gallons of liquefied air were taken to the Institute, and the next day Prof. Fay, who is head of the chemistry department, gave a lecture in which he tried all of the now classic experiments with liquefied air. After the lecture ended, half a dozen of the students remained to observe the professor try some original experiments. Kerosene, alcohol, and turpentine were among the objects experimented with, and they were frozen by the application of liquefied air. Yellow phosphorus was treated with liquefied air, which changed the phosphorus to a crystalline structure. The professor then determined to try red phosphorus, in the hope that liquid air might prove to be a solvent for it. He placed some of it in a beaker glass and poured the liquid air upon it. The mixture was then turned on a piece of paper lying on the table, and he bent over it to observe the result. The liquid air rapidly evaporated, and in a very short time there was nothing on the paper but a little pile of red phosphorus. The professor and students examined it eagerly to note the changes produced. After a moment the phosphorus became a lighter shade of red. The professor at first thought that the combination might have been changed to yellow phosphorus, but further examination led him to believe that it had become solid carbon dioxide, CO_2. While making these experiments, the professor stirred the phosphorus with a glass rod. Suddenly there was a terrific explosion, the glass in the windows was shattered, the room was filled with smoke, and the table broken. The professor gave a cry of pain and clapped his hands to his eyes. His face had been torn and burnt and his thumb nail torn completely off. Fortunately the explosion was a downward one, tearing a great jagged hole in the table, but for the nearness of Dr. Fay's face to the phosphorus he would have probably escaped without serious injury. Prof. Fay was attended by an eye and ear specialist, and it is hoped he will not lose the sight of one eye, as was at first thought.

This accident should sound a note of warning to those of our readers who are fond of chemical experiments. It is not safe to make combinations of chemicals at random. It is far better to try the older and well-established experiments. Only the carefully trained specialist should attempt to do new experiments, and even he should use the greatest possible care, and even though such care is taken, it is not always possible to avoid deplorable accidents like the one just described.

AN IMPROVEMENT IN CLEANING DEVICES.

To provide a device by means of which windows and walls may be effectively cleaned, the amount of water used being under the control of the operator, the brush illustrated in the engraving has been invented. Into the back plate of the brush screws the faucet of a hose. This faucet is provided with a plug by means of which the flow of water may be regulated. The faucet is also provided with lugs connected by means of a clamping screw with the eye of a socket secured to the operating handle. By the use of the clamping



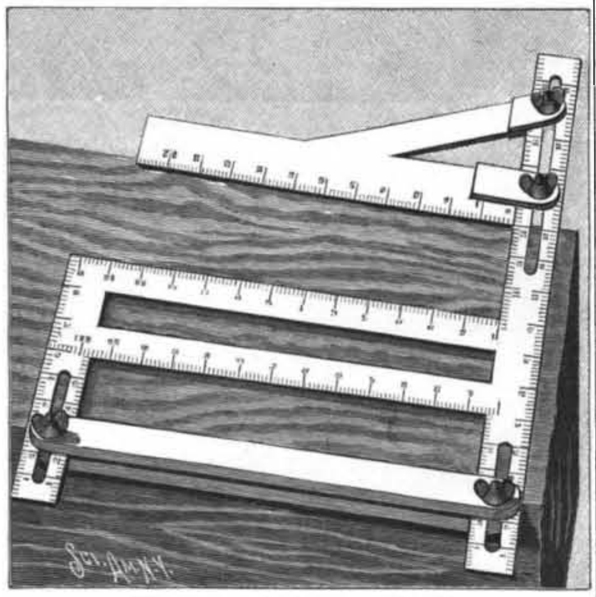
AN IMPROVEMENT IN CLEANING DEVICES.

screw the faucet-body can be moved in an angular position relatively to the handle, thus enabling the operator to apply the brush properly. Apertures are formed in the brush-back, so that the water flowing through the faucet-body may be directed through the apertures to the bristles of the brush and to the object to be cleaned, thus facilitating the removal of dirt. The brush is the invention of James R. Dever, of Olympia, Wash.

AN EFFICIENT FRAMING SQUARE.

A framing square has recently been patented by James H. White, of Ansonia, Ohio, by means of which a carpenter can lay out mortises and tenons on the top, side, or bottom of a piece of wood without the necessity of turning the timber.

As shown in the engraving, the framing square is pro-



WHITE'S FRAMING SQUARE.

vided with two graduated side arms of different lengths connected by a mortise and tenon bar. This mortise and tenon bar is formed with an aperture 1 inch in width, leaving the remaining two portions also 1 inch in width, so that the bar can be used in laying off 1-inch, 2-inch, or 3-inch mortises and tenons. To one slotted end of the long side arm a gage-plate, lying parallel with the mortise and tenon bar is adjustably secured and held in any position within the length of the slot by means of a clamping screw. The other end of the long side arm and the free end of the short side arm are slotted to receive the clamping screws of an adjustable head.

If it is desired to use the square for 7-inch timber and 2 inch mortises and tenons, the inner edge of the head is set 2 inches from that edge of the mortise and tenon bar lowermost in the engraving, and the gage-plate is set 2 inches from the edge of the mortise and tenon bar, uppermost in the engraving. The tenons as well as the mortises can then be laid out by placing the head against one side of the timber and drawing the mortise and tenon lines along the edge of the tenon bar lowermost in the engraving, and along the edge of the aperture of the mortise and tenon bar shown uppermost in the engraving. When set as described, the device can be readily used in laying off 1, 2, or 3-inch mortises 2 inches from the edges of the timber and of any desired length. The head is made adjustable, to enable the carpenter to lay off the mortise any desired distance from the edge or corner of the timber.

Turf Briquettes in Germany.

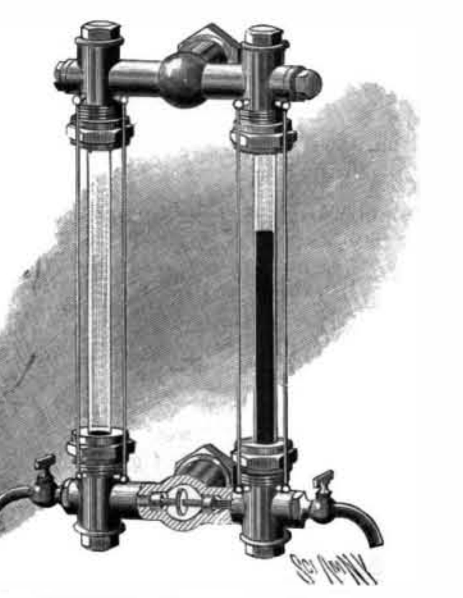
Consul Powell, of Stettin, in his last report, calls attention to a briquette factory at Langenburg, Pomerania, which is somewhat of a new venture, as it has only been in existence for two years, but has proved so far a complete success. It is the consul's opinion that proprietors of turf moors in Scotland and Ireland might start factories of a similar nature with profit. The owner and manager of the factory has taken a patent in England for his machinery; it could, therefore, be employed either by purchase or by royalty. The turf at Langenburg is cut from the adjacent moor and is brought by water in an undried condition, and can be used immediately. The turf on coming from the moor is thrown into the first breaker machine, somewhat in effect like a large turnip cutter, and in this it is broken into small lumps. From the first it passes to the second breaker, and is ground into mull or a fine powder. From here it goes into the drier, a steam cylinder which is filled with the exhaust steam from the engine, and is perforated by tubes much in the manner of boiler tubes, but larger. This cylinder revolves, and being on a gentle slope, the mull passes slowly through the tubes and by this means becomes thoroughly dry. From the drier it passes to a hopper which feeds the plunger. This plunger receives the power of a 75 horse power engine, and by pressing the mull in a form against the preceding briquettes pushes them forward each stroke the width of a briquette.

The factory turns out 80 briquettes a minute, or 35 tons per day, with an average output of about 255,500 centners (12,775 English tons) a year, and the demand is far greater than the supply. the reason for this being that the briquettes are so marvelously cheap—an average price being 13 cents per 130 briquettes, or at the rate of something like two briquettes for ½ cent retail—that this is certainly the poor man's fuel, as they burn slowly and give a fairly good heat. In a closed oven one briquette will remain in a glowing state for twenty-four hours; in an open grate it burns more quickly, but remains for a longer time alight than any coal, giving a good red heat. The cost of working is comparatively light, as but few men are required to attend to the machinery. The cost at Langenburg of material and working one centner (112 pounds) is 35 pf. (9 cents), and per ton about $1.75. With a more extended plant the owner of this factory is of opinion that this could be reduced to $1.25 per ton.—Journal of the Society of Arts.

A SAFETY GAGE-GLASS.

It is the purpose of an invention patented by John McCormick, of Wilmerding, Pa., to provide a gage arranged to cut off water and steam automatically should the gage-glass be broken, and to make a connection with a second glass.

The gage is provided with two glasses joined above and below by tubular connections communicating with the steam and water compartments of the boiler. Both tubular connections have valve-casings and outlets leading from the glasses. In the valve casings, double valves slide which may be seated on valve-seats in the outlets. By referring to the illustration, it will be seen that when the valves are seated in one outlet, the seats in the other outlet are uncovered. On the outlets of the lower tubular connection faucets are arranged, by means of which faucets communication may be automatically established between one of the glasses and the water compartments of the boiler. Should it be desired, for example, to use the right hand glass, then the left hand faucet is for an instant opened, causing the escaping water to shift the valve upon the seats in the left hand outlets and shut off the water from the left glass. Communication will then be established between the upper and lower tubular connections and the outlets of the right hand gage-glass. Should this right hand gage-glass be broken, then the outrushing



McCORMICK'S SAFETY GAGE-GLASS.

steam and water will be automatically cut off by the shifting of the valves on the seats in the right-hand outlets. The seats in the other outlets being uncovered, communication will be established between the tubular connections and the left hand glass. The broken glass may then be removed and replaced by a new one.

A Magnetic Survey of the Globe.

A meeting of scientific men has just concluded its labors at Bristol, England, in connection with the British Association for the Advancement of Science. The body was composed of leading authorities on the study of terrestrial magnetism and included some of world-wide reputation. Magnetic surveys of the United States are by law intrusted to the Coast and Goedetic Survey, so that the United States was represented by Charles A. Schott of the Survey. The questions for deliberation before this body concerned the preparation of a plan for a systematic magnetic survey of the entire globe, and the deliberation of the conference resulted in a general recommendation for that purpose. The principal work of the conference centered in the wider questions involving magnetic observations; their, at present, unsatisfactory distribution over the globe, and their inadequacy as regards numbers. The United States is in a position to take a most important step in the advancement of our knowledge of terrestrial magnetism by establishing and maintaining a well-equipped magnetic observatory on one of the Hawaiian Islands. Their position is unique, being central to a vast unexplored or rather magnetically unknown region and well adapted for the special study of the modifications which the diurnal and secular variations of the magnetic needle are supposed to undergo in consequence of a surrounding ocean as contrasting with a continental surface. The president of the conference, Prof. Rucker, complimented the Coast and Geodetic Survey upon their valuable services.